

Claims

[1] A plasma treating method in which a pulse voltage is applied between opposing discharge electrodes (4) to produce a corona discharge between pointed ends of said discharge electrodes (4), and a surface of a workpiece is irradiated with excited species including plasma produced by the corona discharge, thereby treating the surface, wherein

one of a secondary output of a transformer (15) is branched to be supplied to one discharge electrodes (4) of different discharging units (13), and another secondary output of said transformer (15) is supplied to other discharge electrodes (4) of said different discharging units (13) via rectifiers (19) (20), respectively, whereby a corona discharge is alternately generated between said discharge electrodes (4) of said discharging units (13).

[2] A plasma treating method according to claim 1, wherein a rectangular pulse voltage is used as the pulse voltage.

[3] A plasma treating method according to claim 1, wherein a pulse voltage configured by plural pulsating waves which are obtained by full-wave rectifying an AC voltage is used as the pulse voltage.

[4] A plasma treating method according to any one of claims 1 to 3, wherein a magnetic field is formed in vicinities of said pointed ends of said discharge electrodes (4) and in

places where charged particles in the plasma exist, and the excited species including plasma are irradiated toward said surface of said workpiece by a pushing force acting on charged particles moving in the magnetic field.

[5] A plasma treating method according to any one of claims 1 to 4, wherein air or a reactive gas is introduced between said discharge electrodes (4) at atmospheric pressure or a vicinity of atmospheric pressure, whereby an excitation gas flow including plasma is caused to be irradiated toward said surface of said workpiece.

[6] A plasma treating apparatus in which a pulse voltage is applied between opposing discharge electrodes (4) to produce a corona discharge between pointed ends of said discharge electrodes (4), and a surface of a workpiece is irradiated with excited species including plasma produced by the corona discharge, thereby treating the surface, wherein

one of a secondary output of a transformer (15) is branched, rectifiers (19) (20) are disposed in branch circuits (18), respectively, said branch circuits (18) are connected to one discharge electrodes (4) of different discharging units (13), another secondary terminal of said transformer (15) is branched to be connected to other discharge electrodes (4) of said different discharging units (13), and the corona discharge is alternately generated

between said discharge electrodes (4) based on a pulse voltage which is applied between said discharge electrodes (4) in each of said discharging units (13).

- [7] A plasma treating apparatus according to claim 6, wherein magnetic field forming means (M) is disposed, said magnetic field forming means forming a magnetic field in vicinities of said pointed ends of said discharge electrodes (4) which are opposingly placed, and in places where charged particles in the plasma exist, to be able to apply a pushing force to a charged particle moving in the magnetic field, the pushing force causing excited species including plasma to be irradiated toward said surface of said workpiece.
- [8] A plasma treating apparatus according to claim 7, wherein said magnetic field forming means (M) is configured by: a permanent magnet (8); a pair of magnetic members which are connected to N and S poles of said permanent magnet (8), and which elongate to vicinities of said pointed ends of said pair of discharge electrodes (4); and a pair of pole pieces (6) (7) which are continuous to tip ends of said magnetic members, and which form a gap between end faces.
- [9] A plasma treating apparatus according to claim 7, wherein said magnetic field forming means (M) is configured by: an electromagnet connected to a DC power source; a pair of magnetic members which are connected to N and S poles of

said electromagnet, and which elongate to vicinities of said pointed ends of said pair of discharge electrodes (4); and a pair of pole pieces (6) (7) which are continuous to tip ends of said magnetic members, and which form a gap between end faces.

- [10] A plasma treating apparatus according to any one of claims 6 to 9, wherein means for introducing air or a reactive gas between said discharge electrodes at atmospheric pressure or a vicinity of atmospheric pressure is disposed, and the air or the reactive gas is introduced via said means, whereby an excitation gas flow including plasma is caused to be irradiated toward said surface of said work-piece.